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(71)Applicant : SONY CORP

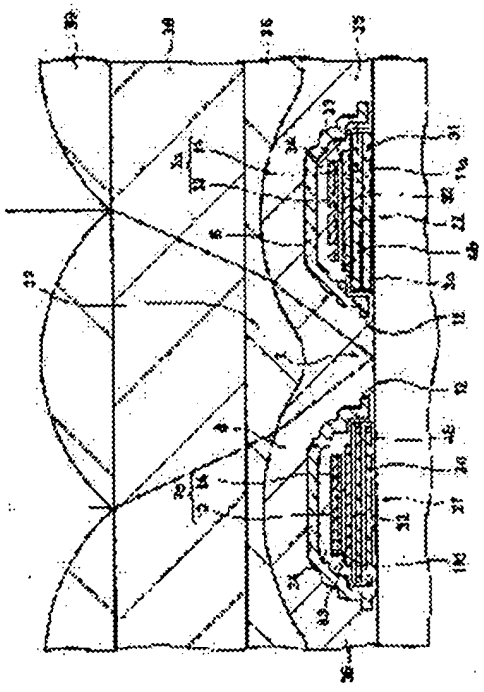
(72)Inventor : MARUYAMA YASUSHI
SUGIMOTO MASARU

(54) SOLID-STATE IMAGE PICK-UP ELEMENT AND ITS MANUFACTURING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a solid-state image pick-up element which can be driven in a high speed, restrict a dark current, and increase sensitivity; and to provide its manufacturing method.

SOLUTION: Shunt wirings 7a, 7d of a transfer electrode structure a solid- state image pick-up element formed with a laminated film of a high fusion metal 13 and a nitride or oxide 14 of the high fusion metal. Furthermore, there are a step of forming the shunt wiring layers 7a, 7b of the laminated film composed of the nitride layer or oxide layer 14 of the high fusion metal and the high fusion metal layer 13 thereon on transfer electrodes 3a, 4b; and a step of adhering an insulation film 36 so as to have a recess part on a sensor 2, then to thermally threat at 800 to 900°C, to manufacture a solid-state image pick-up element.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The solid state image sensor with which shunt wiring of a transfer electrode is characterized by what was formed of the cascade screen with the nitride of a refractory metal and a refractory metal, or an oxide.
[Claim 2] The solid state image sensor according to claim 1 characterized by having a lens in a layer on a sensor.
[Claim 3] The manufacture approach of the solid state image sensor characterized by having the process which performs 800-900-degree C heat treatment after carrying out covering formation of the insulator layer so that it may have a crevice the process which forms the shunt wiring layer of the cascade screen which consists of the nitride layer of a refractory metal, or an oxide layer and the refractory metal layer on it on a transfer electrode, and on a sensor.
[Claim 4] The manufacture approach of the solid state image sensor according to claim 3 characterized by having the process which forms the ingredient film with a larger refractive index than this insulator layer, and forms the lens in a layer on the above-mentioned insulator layer.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the solid state image sensor which forms a shunt wiring layer and changes on a transfer electrode, and its manufacture approach.
[0002]
[Description of the Prior Art] Generally polycrystalline silicon is used for the transfer electrode of a solid state image sensor. At this time, since resistance of the polycrystalline silicon of a transfer electrode was high, the propagation delay happened and the high-speed drive of an image sensor and large-area-izing of an image sensor were difficult.
[0003] In order to solve an above-mentioned problem, the wiring layer ******** shunt wiring layer which consists of a low metal of resistance through an insulator layer is formed on a transfer electrode, and the configuration which connected this shunt wiring layer to the transfer electrode through the contact section is proposed. Since propagation is made through the shunt wiring layer of low resistance by taking such a configuration, improvement in the speed of a drive is attained.
[0004] The sectional view near the light sensing portion of a CCD solid state image sensor is shown in drawing 6 as an example of the solid state image sensor in which the shunt wiring layer was formed. Although this CCD solid state image sensor 50 is not illustrated on the front face of the semi-conductor substrate 51, the channel stop field which carries out separation with the light sensing portion which consists of a photodiode etc., the perpendicular charge transfer section to which a charge is transmitted, the read-out section which reads a signal charge between a light sensing portion and the perpendicular charge transfer section, and the adjoining pixel is formed, and the transfer electrode 53 is formed through an insulator layer 54 on fields other than a light sensing portion. Drawing 6 shows the cross section of the part with which two layers of transfer electrodes 53 have lapped through the insulator layer 54.
[0005] And the shunt wiring layer 56 formed with metals, such as aluminum and a refractory metal, through the insulator layer 54 on the transfer electrode 53 is arranged. Moreover, a buffer coat (buffer wiring) 55 is formed between the shunt wiring layer 56 and the transfer electrode 53, and this buffer coat 55 is connected to the transfer electrode 53 and the shunt wiring layer 56 by the contact section prepared in the part which is not illustrated, respectively.
[0006] On the shunt wiring layer 56, the wrap protection-from-light layer 57 is formed in the whole through an insulator layer 54. Opening 52 is formed on a light sensing portion, and this protection-from-light layer 57 covers image pick-up fields other than opening 52, and is formed. Furthermore, on the protection-from-light layer 57, the lens 59 on chip is formed through the insulating layer 58 to which flattening of the front face was carried out, and he condenses the light which carried out incidence with this lens on chip, and is trying to go to opening 52.
[0007] In this CCD solid state image sensor 50, by connecting the shunt wiring layer 56 to the transfer electrode 53 through a buffer coat 55, low resistance-ization of the transfer electrode 53 can be attained and velocity of propagation can be improved.

[0008]
[Problem(s) to be Solved by the Invention] However, if refractory metals, such as a tungsten, are used for the shunt wiring layer 56, the problem on which contact resistance with the shunt wiring layer 56 and the transfer electrode (are recording electrode) 53 goes up with the configuration which carried out direct continuation of the shunt wiring layer 56 and the transfer electrode 53 by heat treatment after the insulator layer formation on the protection-from-light layer 57 without forming a buffer coat 55, and contact resistance with the shunt wiring layer 56 and a buffer coat 55 goes up with the configuration of drawing 6 , respectively will occur.
[0009] In case the polycrystalline silicon and the refractory metal of a buffer coat or a transfer electrode react by heat treatment, a silicide layer generates the rise of this contact resistance in the contact section and this silicide layer generates, the volume expands, the shunt wiring layer 56 is raised, and it has become the main causes that clearance is generated into a contact part with a buffer coat or a transfer electrode.
[0010] If it heat-treats at an elevated temperature on the other hand after forming the insulator layer on the protection-from-light layer 57, if aluminum is used for the shunt wiring layer 56, in order that aluminum may fuse, hot heat treatment cannot be performed. Therefore, since the defect by the damage which the silicon substrate 51 received on the occasion of patterning of protection-from-light layer 57 grade cannot fully be recovered, the dark current increases. Moreover, in order to make the insulator layer on the shunt wiring layer 56 into the insulator layer which can form membranes at low temperature and to secure a coverage and pressure-proofing enough in such an insulator layer, it is necessary to form an insulator layer thickly. Therefore, the thickness from silicon substrate 51 front face to protection-from-light layer 57 upper limit becomes thick, the use effectiveness of light falls, and there is a trouble of sensibility getting worse.
[0011] While a high-speed drive is possible and being able to control the dark current in this invention for solution of the problem mentioned above, the solid state image sensor which can make sensibility high, and its manufacture approach are offered.
[0012]
[Means for Solving the Problem] As for the solid state image sensor of this invention, shunt wiring of a transfer electrode is formed of a cascade screen with the nitride of a refractory metal and a refractory metal, or an oxide.
[0013] The manufacture approach of the solid state image sensor of this invention has the process which performs 800-900-degree C heat treatment, after carrying out covering formation of the insulator layer so that it may have a crevice the process which forms the shunt wiring layer of the cascade screen which consists of the nitride layer of a refractory metal, or an oxide layer and the refractory metal layer on it on a transfer electrode, and on a sensor.
[0014] When formed of the cascade screen with the nitride of a refractory metal and a refractory metal, or an oxide, while shunt wiring of a transfer electrode attains low resistance-ization of a transfer electrode with shunt wiring according to the configuration of above-mentioned this invention, since the refractory metal is used, heat treatment in the elevated temperature in the case of manufacture is possible.
[0015] According to the above-mentioned this invention process, the defect on the front face of a substrate can be recovered by performing 800-900-degree C heat treatment. Moreover, since a shunt wiring layer is formed by the cascade screen in which the refractory metal layer was formed on the nitride layer of a refractory metal, or the oxide layer, when it heat-treats, the reaction of a transfer electrode etc. and a shunt wiring layer can be controlled, the rise of contact resistance with a transfer electrode etc. can be controlled, and low resistance-ization of a transfer electrode can be attained.
[0016]
[Embodiment of the Invention] This invention is the solid state image sensor with which shunt wiring of a transfer electrode was formed of the cascade screen with the nitride of a refractory metal and a refractory metal, or an oxide.
[0017] Moreover, this invention is considered as the configuration which has a lens in a layer on a

sensor in the above-mentioned solid state image sensor.
[0018] This invention is the manufacture approach of a solid state image sensor of having the process which performs 800-900-degree C heat treatment, after carrying out covering formation of the insulator layer so that it may have a crevice the process which forms the shunt wiring layer of the cascade screen which consists of the nitride layer of a refractory metal, or an oxide layer and the refractory metal layer on it on a transfer electrode, and on a sensor.
[0019] Moreover, this invention has the process which forms the ingredient film with a larger refractive index than this insulator layer, and forms the lens in a layer on an insulator layer in the manufacture approach of the above-mentioned solid state image sensor.
[0020] A transfer electrode can be formed for example, in a polycrystalline silicon layer.
[0021] A shunt wiring layer can be formed in a cascade screen with the layer of the nitride of refractory metal layers, such as a tungsten, and this refractory metal, or an oxide.
[0022] A buffer coat can be formed for example, in a polycrystalline silicon layer. Moreover, it can also form by the polycide layer which consists of a polycrystalline silicon layer and refractory metal silicide, such as a metaled silicon compound, for example, tungsten silicide etc., for example. In this case, the polycrystalline silicon layer of a polycide layer and the polycrystalline silicon layer of a transfer electrode are connected, and the metaled silicon compound layer and shunt wiring in a polycide are connected.
[0023] And it connects with the contact hole which carried out opening to the insulator layer between these, and a transfer electrode and a buffer coat connect a buffer coat and a shunt wiring layer with the contact hole which carried out opening to the insulator layer between these. In this case, the contact section of a transfer electrode and a buffer coat and the contact section of a buffer coat and shunt wiring are good to form in a mutually different distant location.
[0024] Drawing 1 - drawing 4 show the outline block diagram of the solid state image sensor concerning the gestalt of 1 operation of this invention. The gestalt of operation shown in drawing 1 - drawing 4 is the case where this invention is applied to the CCD solid state image sensor of a frame INTARAIN mold.
[0025] A drive according [this CCD solid state image sensor 10] to four phases is made, and a two-layer polycrystalline silicon layer functions as a transfer electrode (are recording electrode). That is, clock signal phi[of signal / of clock signal phib of 2nd phase / or 4th phase] d is given to a layer [1st] polycrystalline silicon layer through a shunt wiring layer and a buffer coat (buffer wiring) at a layer [2nd] polycrystalline silicon layer, respectively for the signal of clock signal phia of the 1st phase, or clock signal phic of the 3rd phase.
[0026] First, a layout is explained with reference to drawing 1 . The direction of V in drawing (perpendicular) is a direction of transfer of a charge, and it becomes the direction of transfer of the level register which the direction of H in drawing (horizontal) does not illustrate. In addition, the shunt wiring layer 7 is not illustrated in drawing 1 . Two or more buffer coats 11a, 11b, 11c, and 11d are formed in the direction of V in order by the abbreviation straight-line-like pattern, and the perpendicular charge transfer section (not shown) which constitutes a perpendicular CCD register under the lower part of these buffer coats 11 (11a, 11b, 11c, 11d) and the transfer electrodes 3 (3a, 3c) and 4 (4b, 4d) is arranged. The shunt wiring layer 7 is formed by the abbreviation straight-line-like pattern, respectively on each buffer coats 11a, 11b, 11c, and 11d.
[0027] Between the perpendicular charge transfer sections, the sensor section 2 divided for every pixel is formed. It consists of a photodiode and, as for the sensor section 2, the window part 12 of the protection-from-light layer 8 which carried out opening to the shape of a rectangle which makes the direction of V a longitudinal direction is formed on the sensor section 2, respectively. And a channel stop field (not shown) is formed in the drawing Nakamigi side of each sensor section 2, and a channel stop field and the read-out section (not shown) are formed in the left-hand side in drawing of each sensor section 2.
[0028] In this CCD solid state image sensor 10, the transfer electrodes 3 and 4 consist of a layer [1st] polycrystalline silicon layers 3a and 3c and layer [2nd] polycrystalline silicon layers 4b and 4d. These [1st] and the layer [2nd] polycrystalline silicon layers 3a, 3c, 4b, and 4d have extended considering

the direction of H as a longitudinal direction, respectively, spread on the perpendicular charge transfer section, and are formed in the pattern made thin in the field between sensor section 2 comrades.
[0029] In the direction of V in drawing 2 , polycrystalline silicon layer 3a of the 1st layer, polycrystalline silicon layer 4b of the 2nd layer, Polycrystalline silicon layer 3c of the 1st layer and 4d of layer [2nd] polycrystalline silicon layers It is gone round and formed so that the sensor section 2 may be surrounded. The layer [these / 1st] polycrystalline silicon layers 3a and 3c and the layer [2nd] polycrystalline silicon layers 4b and 4d It is arranged so that the edges of the polycrystalline silicon layers 3 and 4 two-layer by the field between sensor section 2 comrades or the part on the perpendicular charge transfer section may lap on a flat surface.
[0030] Clock signal phia of the 1st phase is supplied to polycrystalline silicon layer 3a of the 1st layer through the shunt wiring layer 7 and buffer coat 11a, and clock signal phib of the 2nd phase is supplied to it through the shunt wiring layer 7 and buffer coat 11b at polycrystalline silicon layer 4b of the 2nd layer. Moreover, clock signal phic of the 3rd phase is supplied to polycrystalline silicon layer 3c of the 1st layer through the shunt wiring layer 7 and buffer coat 11c, and clock signal phib of the 4th phase is supplied to 4d of layer [2nd] polycrystalline silicon layers through the shunt wiring layer 7 and 11d of buffer coats.
[0031] In drawing 1 , the connection with the transfer electrode and buffer coat 11 (11a, 11b, 11c, 11d) by the layer [1st] polycrystalline silicon layers 3a and 3c or the layer [2nd] polycrystalline silicon layers 4b and 4d It is carried out respectively through contact holes 5a, 5b, 5c, and 5d, and connection between a buffer coat 11 and the shunt wiring layer 7 which is not illustrated is made respectively through contact holes 6a, 6b, 6c, and 6d.
[0032] As shown in drawing 1 , when a contact holes [of the transfer electrodes 3 and 4 and a buffer coat 11 / 5a, 5b 5c, and 5d] location turns into arrangement aslant located in a line and only the one perpendicular charge transfer section shifts in the direction of H, on a flat surface, it shifts in the direction of V by 1 transfer electrode. Moreover, the contact holes [of a buffer coat 11 and the shunt wiring layer 7 / 6a 6b, 6c, and 6d] location should shift from the contact holes 5a, 5b, 5c, and 5d of the transfer electrodes 3 and 4 and buffer coat 1 corresponding to the same buffer coat 11 by the about 2 transfer electrode, and has become what was similarly located in a line aslant.
[0033] Furthermore, with reference to drawing 2 - drawing 4 , the structure of this CCD solid state image sensor 10 is explained in detail. The enlarged drawing of an important section with which drawing 2 is equivalent to the two perpendicular charge transfer sections of drawing 1 , an A-A sectional view [in / in drawing 3 / drawing 2], and drawing 4 are the B-B sectional views in drawing 2 .
[0034] The sensor section 2 is formed between the two perpendicular charge transfer sections 21 and 22 shown in drawing 2 . As shown in drawing 3 and drawing 4 R> 4, on the perpendicular charge transfer section 21 and 22, the transfer electrode is prepared through the insulator layer 31. This transfer electrode consists of 4d of layer [2nd] polycrystalline silicon layers to which polycrystalline silicon layer 3c of the 1st layer to which polycrystalline silicon layer 4b of the 2nd layer to which polycrystalline silicon layer 3a of the 1st layer to which clock signal phia of the 1st phase is supplied, and clock signal phib of the 2nd phase are impressed, and clock signal phic of the 3rd phase are impressed, and clock signal phid of the 4th phase are impressed. In addition, the field between the layer [1st] polycrystalline silicon layers 3a and 3c and the sensor section 2 reads, and it becomes the section.
[0035] the layer [1st] polycrystalline silicon layers 3a and 3c and the layer [2nd] polycrystalline silicon layers 4b and 4d are formed by turns through an insulator layer 32 along the charge direction of transfer of the perpendicular charge transfer sections 21 and 22 -- having -- **** -- each of the layer [1st] polycrystalline silicon layers 3a and 3c -- at the edge of a charge direction of transfer, the layer [2nd] polycrystalline silicon layers 4b and 4d are lapped and formed upwards.
[0036] And buffer coats 11a and 11d are used as the pattern of the shape of an abbreviation straight line by which perpendicular direction (it corresponds to direction of transfer) extension was carried out only on each perpendicular charge transfer section 22 and 21, and are connected to polycrystalline silicon layer 3a of the 1st layer, and 4d of layer [2nd] polycrystalline silicon layers through the contact holes 5a and 5d formed in the insulator layer 32, respectively. That is, it does not connect directly but

polycrystalline silicon 3a of the 1st layer and 4d of layer [2nd] polycrystalline silicon layers used as a transfer electrode, and the shunt wiring layer 7 are connected through buffer coats 11a and 11d.
[0037] And these buffer coats 11a and 11d are connected to each shunt wiring layer 7a and 7d through the contact holes 6a and 6d which carried out opening of the interlayer insulation film 33. Consequently, clock signal phia of the 1st phase is supplied to polycrystalline silicon layer 3a of the 1st layer through buffer coat 11a from shunt wiring layer 7a, and clock signal phid of the 4th phase is supplied to 4d of layer [2nd] polycrystalline silicon layers through 11d of buffer coats from 7d of shunt wiring layers. In addition, the same is said of clock signal phib of the 2nd phase and the 3rd phase, and phic.
[0038] On the shunt wiring layers 7a and 7d, the protection-from-light layer 8 is formed so that the transfer electrodes 3a and 4b may be covered through an interlayer insulation film 34. While the protection-from-light layer 8 has opening 12, and changes on the sensor section 2 and light carries out incidence to the sensor section 2 through this opening 12, light can be prevented from carrying out incidence of it to the transfer electrodes 3a and 4b.
[0039] The insulator layer 35 which consists of BPSG (boron Lynn and silica glass: refractive index n= 1.6) has covered the protection-from-light layer 8 top, and it has the crevice on the sensor section 2 in this insulator layer 35. The high refraction ingredient layer 36 which fills this crevice, for example, consists of Plasma SiN (refractive index n= 1.9) is formed, and the lens 37 in a layer is formed in a crevice. In addition, this high refractive-index ingredient layer 36 is constituted so that it may converge the light from the upper part with the lens 37 in a layer using an ingredient at least with a refractive index higher than an insulator layer 35. Furthermore on it, the flattening insulating layer 38 to which flattening of the front face was carried out is formed, and the lens 39 on chip is formed on it.
[0040] With these lenses 39 on chip and the lens 37 in a layer, incident light can be condensed, incidence can be carried out to the sensor section 2, the use effectiveness of light can be raised and sensibility can be made high.
[0041] In addition, by drawing 3 between the lens 37 in a layer, and the lens 39 on chip, a color filter may be formed in the part used as the flattening insulating layer 38 if needed.
[0042] Especially in the gestalt of this operation, the shunt wiring layer 7 (7a, 7b, 7c, 7d) is formed by the cascade screen of the refractory metal layers 13, such as a tungsten, molybdenum, and a tantalum, and the nitride layer of this refractory metal or the oxide layer 14 of a refractory metal.
[0043] And by connecting with a buffer coat 11 by the nitride or oxide layer 14 of this refractory metal in the contact section 6 (6a, 6b, 6c, 6d) by using the nitride of a refractory metal, or the oxide layer 14 as the substrate film While being able to reduce the polycrystalline silicon layer of a buffer coat 11, or contact resistance with a polycide, when elevated-temperature heat treatment is carried out after that, the reaction of the shunt wiring layer 7 and buffer coat 11 in the contact section 6 can be controlled.
[0044] Moreover, it forms with a refractory metal, for example, a tungsten, also about the protection-from-light layer 8. In case the insulator layers 34 and 35 formed later when the shunt wiring layer 7 and the protection-from-light layer 8 are using the refractory metal are formed, it becomes possible to heat-treat at an elevated temperature.
[0045] Furthermore, since the pressure-proofing of protection-from-light nature, a coverage, and an interlayer insulation film of the tungsten is good, it can form thinly the shunt wiring layer 7 and the protection-from-light layer 8. Thereby, total thickness to protection-from-light layer 8 upper limit of an image sensor can be made thin, consequently sensibility shading etc. is improved.
[0046] Furthermore, after the insulator layer 35 on the protection-from-light layer 8 forms this insulator layer 35, at a 800-900-degree C elevated temperature, it heat-treats and it is formed so that it may mention later. A reflow of the insulator layer 35 is carried out by this heat treatment, and it becomes the configuration which has a crevice and is formed in the front face for forming the lens 37 in a layer.
[0047] Since elevated-temperature heat treatment cannot be performed when aluminum film is used for shunt wiring, it cannot consider as the configuration which has the crevice which carries out a reflow of the insulator layer 35, and constitutes the refracting interface of such a lens 37 in a layer. On the other hand, with the gestalt of this operation, a refractory metal, its nitride, or an oxide is used for shunt wiring, since elevated-temperature heat treatment is possible, the lens 37 in a layer can be formed and

incident light can be condensed.
[0048] The solid state image sensor 10 which has the shunt wiring layer 7 of above-mentioned two-layer structure is formed as follows, for example. First, a layer [1st] polycrystalline silicon layer is deposited on the insulator layer 31 which covered the semi-conductor substrate, and the transfer electrode 3 which carries out patterning of this to a predetermined pattern, and consists of a layer [1st] polycrystalline silicon layer is formed.
[0049] Next, after covering the transfer electrode 3 which consists of this layer [1st] polycrystalline silicon layer and forming an insulator layer 32, a layer [2nd] polycrystalline silicon layer is deposited and the transfer electrode 4 which carries out patterning of this to a predetermined pattern, and consists of a layer [2nd] polycrystalline silicon layer is formed.
[0050] The transfer electrode 4 which consists of this layer [2nd] polycrystalline silicon layer is covered, and an insulator layer 32 is formed. And opening for contact section 5 is formed in the location on each transfer electrodes 3a, 4b, and 3c of this insulator layer 32, and 4d.
[0051] Next, opening for contact section 5 is also covered and a buffer coat 11, for example, a polycrystalline silicon layer, is deposited. Patterning is carried out to the shape of a straight line as shows this to drawing 1 R> 1, and a buffer coat 11 is formed.
[0052] Next, a buffer coat 11 is covered, an insulator layer 33 is formed, and opening for contact section 6 is formed in the location distant from the above-mentioned contact section 5 on the buffer coat 11 of this insulator layer 33.
[0053] Next, opening for contact section 6 is also covered, the nitride layer or oxide layers 14 of a refractory metal, such as a tungsten, are formed, on it, laminating formation of the refractory metal layer 13 is carried out, patterning of these cascade screens is carried out to the shape of same straight line as a buffer coat 11, and the shunt wiring layer 7 is formed.
[0054] Next, after covering the shunt wiring layer 7 and forming an insulator layer 34, the protection-from-light layer 8 which consists of refractory metals, such as a tungsten, is formed on an insulator layer 34. The protection-from-light layer 8 forms opening on the sensor section 2, and light is made to carry out incidence only to the sensor section.
[0055] Next, covering formation of the insulator layer 35 which covers this, for example, consists of BPSG on the protection-from-light layer 8 is carried out. And it heat-treats to an insulator layer 35. The conditions of this heat treatment are preferably made into 5 minutes or more at 800-900 degrees C, and make the processing time more preferably 5 minutes - 1 hour.
[0056] By this heat treatment, the insulator layer 35 on the protection-from-light layer 8 serves as the shape of surface type with a crevice from the shape of surface type which met the level difference of the protection-from-light layer 8, as a reflow is carried out and it is shown in drawing 3 . Moreover, the defect of the silicon substrate surface produced in response to the damage by pattern etching etc. can be recovered by this heat treatment.
[0057] In addition, although the so-called lamp annealing is performing short heat treatment for 850 degree C and 1 minute when the nitride film of a refractory metal is formed in the substrate film of the conventional, for example, refractory metal, film and wiring is formed, in this lamp annealing, it is difficult to fully recover a defect. Moreover, a reflow of the insulator layer 35 is not carried out.
[0058] Next, the high refractive-index ingredient layers 36, such as Plasma SiN, are formed on an insulator layer 35, and the lens 37 in a layer is formed on the crevice of an insulator layer 35.
[0059] After this, the flattening insulating layer 38 for flattening on top and the lens 39 on chip can be formed, and the CCD solid state image sensor 10 can be manufactured.
[0060] Thus, while having a buffer coat 11 between the transfer electrode 4 and the shunt wiring layer 7, the configuration in which the lens 37 in a layer was formed on the sensor section 2 can be manufactured easily.
[0061] According to the gestalt of this above-mentioned operation, since the shunt wiring layer 7 is formed by the cascade screen with the refractory metal layer 13, the nitride layer of the refractory metal of the substrate, or an oxide layer 14, the reaction of the shunt wiring layer 7 and a buffer coat 11 can be controlled, and the problem on which the contact resistance between these shunt wiring layer 7 of a

transfer electrode, an are recording electrode, and a refractory metal and a buffer coat 11 goes up can be avoided.

[0062] Moreover, according to the gestalt of this operation, since the refractory metal, for example, a tungsten, is used for the shunt wiring layer 7 and the protection-from-light layer 8, after forming the insulator layer 35 on the protection-from-light layer 8, it is possible to heat-treat by the temperature of 800-900 degrees C and the time amount for 5 minutes or more, and an insulator layer 35 can be made into the shape of surface type with the crevice which can form the lens 37 in a layer. Generating of a smear can be reduced, while being able to form the lens 37 in a layer, being able to make incident light condense by this and raising sensibility. Moreover, since the defect of the substrate produced in response to the damage by this heat treatment is recoverable, generating of the dark current can be reduced.

[0063] Moreover, according to the gestalt of this operation, by connecting with the transfer electrodes 3 and 4 and forming the shunt wiring layer 7 which consists of a refractory metal layer through a buffer coat 11, the transfer electrodes 3 and 4 can be formed into low resistance, and a propagation delay can be reduced. Thus, since a propagation delay is reduced, the drive of a solid state image sensor is accelerable, and since a transfer of a long distance also becomes possible, large area-ization of an image sensor can be attained.

[0064] Moreover, since low resistance-ization is attained by the shunt wiring layer 7, even if it makes the transfer electrodes 3 and 4 thin, increase of resistance can be suppressed, and it becomes possible to attain thin shape-ization of a solid state image sensor. Thereby, the height from the sensor section 2 to the upper limit of the protection-from-light layer 8 can be reduced, and the use effectiveness of light can be gathered further. Moreover, even if it forms the lens 37 in a layer, the thickness of a solid state image sensor can be prevented from increasing not much.

[0065] In addition, with the gestalt of above-mentioned operation, although the transfer clock was explained as four phases, it is not limited especially that what is necessary is just the polyphase of two or more phases. Moreover, the image pick-up equipment using a solid state image sensor may not be limited to a frame INTARAIN mold, but an INTARAIN mold is sufficient as it.

[0066] Moreover, the configuration 5 and 6 formed on the contact section 5 between a buffer coat 11 and the transfer electrodes 3 and 4, i.e., the two contact sections, may be the same location superficially that it connects on a buffer coat 11 and the contact section 6 of a buffer coat 11 and the shunt wiring layer 7 should just be formed.

[0067] Although the shunt wiring layer 7 was formed under the protection-from-light layer 8 with the gestalt of above-mentioned operation, it is good also as a configuration formed in the upper layer of the protection-from-light layer 8. In this case, these contact section 6 circumferences are used as the pattern except the protection-from-light layer 8 so that connection between the shunt wiring layer 7 and a buffer coat 11 can be performed.

[0068] Moreover, a buffer coat 11 can also be formed as mentioned above by the so-called polycide of the two-layer structure of the polycrystalline silicon layer 15 and the metal silicide layer 16. The sectional view in this case is shown in drawing 5 . In this case, contact resistance can be made sufficiently small by the transfer electrodes 3 and 4 and the polycrystalline silicon layer 15 of a buffer coat 11 which consist of a polycrystalline silicon layer.

[0069] Moreover, with the gestalt of above-mentioned operation, although the shunt wiring layer 7 and the transfer electrodes 3 and 4 were connected through the buffer coat 11, also in the configuration which carried out direct continuation of a shunt wiring layer and the transfer electrode, this invention is applicable. The reaction of the polycrystalline silicon of a transfer electrode and a shunt wiring layer can be controlled in the case of heat treatment by applying this invention and forming the nitride layer or oxide layer of a refractory metal in the substrate of a refractory metal layer for a shunt wiring layer.

[0070] Furthermore, with the gestalt of above-mentioned operation, although it was the configuration in which the lens 37 in a layer was formed on the sensor section 2, even if it is the configuration of not forming the lens 37 in a layer, it becomes possible by applying this invention to perform hot heat treatment. And by this heat treatment, since the defect on the front face of a substrate is recoverable, generating of the dark current can be controlled.

[0071] This invention is not limited to the gestalt of above-mentioned operation, and, in addition to this, various configurations can take it in the range which does not deviate from the summary of this invention.

[0072]

[Effect of the Invention] According to above-mentioned this invention, low resistance-ization of a transfer electrode can be attained with shunt wiring formed of the cascade screen with the nitride of a refractory metal and a refractory metal, or an oxide. Therefore, according to this invention, since the propagation delay by the reduction in resistance of wiring can be decreased, improvement in the speed and large-area-izing of a drive can be attained.

[0073] Moreover, according to this invention, since the refractory metal is used for shunt wiring, 800-900-degree C hot heat treatment is possible in the case of manufacture, by performing this heat treatment, the defect on the front face of a substrate can be recovered, and generating of the dark current can be controlled.

[0074] Moreover, since a shunt wiring layer is formed by the cascade screen in which the refractory metal layer was formed on the nitride layer of a refractory metal, or the oxide layer according to this invention, when it heat-treats, the reaction of a transfer electrode etc. and a shunt wiring layer can be controlled by the nitride layer or oxide layer of a refractory metal, the rise of contact resistance with a transfer electrode etc. can be controlled, and low resistance-ization of a transfer electrode can be attained.

[0075] Moreover, a smear can be reduced while raising sensibility, since incident light can be condensed and incidence can be carried out to a sensor, when it considers as the configuration which forms the lens in a layer by the high refractive-index ingredient layer on a sensor. Especially, by 800-900-degree C heat treatment, a crevice can be formed in an insulator layer and the lens in a layer can be formed easily.

[0076] Since according to this invention it becomes possible to make a transfer electrode thin by forming shunt wiring and using a refractory metal for shunt wiring and shunt wiring can also be made thin, thin shape-ization of a solid state image sensor can be attained, sensibility shading can be improved, and sensibility can be improved. Moreover, increase of the thickness of the solid state image sensor at the time of forming the above-mentioned lens in a layer can be suppressed.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline block diagram (top view) of the solid state image sensor concerning the gestalt of 1 operation of this invention.
[Drawing 2] It is the enlarged drawing of the important section of drawing 1 .
[Drawing 3] It is a sectional view in A-A of drawing 2 .
[Drawing 4] It is a sectional view in B-B of drawing 2 .
[Drawing 5] It is a sectional view at the time of forming a buffer coat with the polycide film.
[Drawing 6] It is the sectional view of the light sensing portion circumference of the CCD solid state image sensor in which the shunt wiring layer was formed.
[Description of Notations]
2 Sensor Opening, 3, 3a, 3C Transfer Electrode of the 1st Layer, 4, 4B, 4D Transfer Electrode of Two-layer Eye, 5, 5a, 5b, 5c, 5d, 6, 6a, 6b, 6c, 6d Contact section, 7, 7a, 7b, 7c, 7d A shunt wiring layer, 8 A protection-from-light layer, 10CCD solid state image sensor, 11, 11a, 11b, 11c, 11d A buffer coat, 13 refractory metal layers, 14 The nitride layer (or oxide layer of a refractory metal) of a refractory metal, 15 Polycrystalline silicon layer, 16 21 A metal silicide layer, 22 The perpendicular charge transfer section, 31, 32, 33, 34, 35 An insulator layer and 36 A quantity refraction ingredient layer, 37 The lens in a layer, 38 A flattening insulating layer, 39 A lens on chip, V A perpendicular direction, H Horizontal

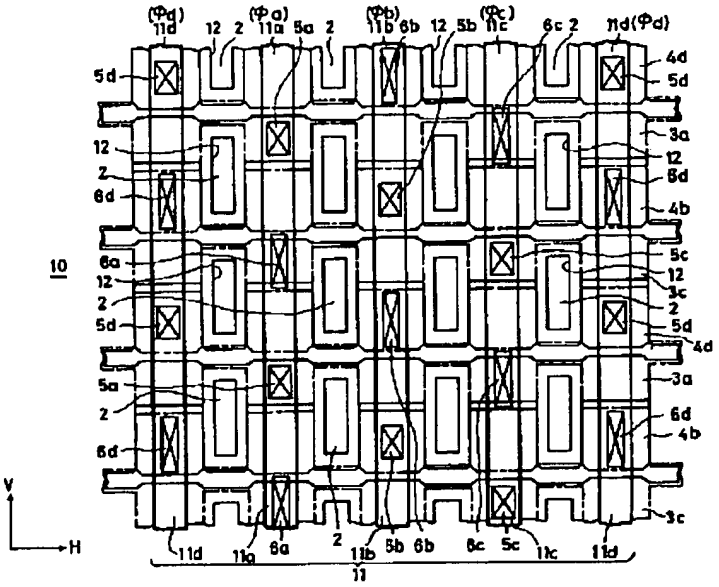
[Translation done.]

* NOTICES *

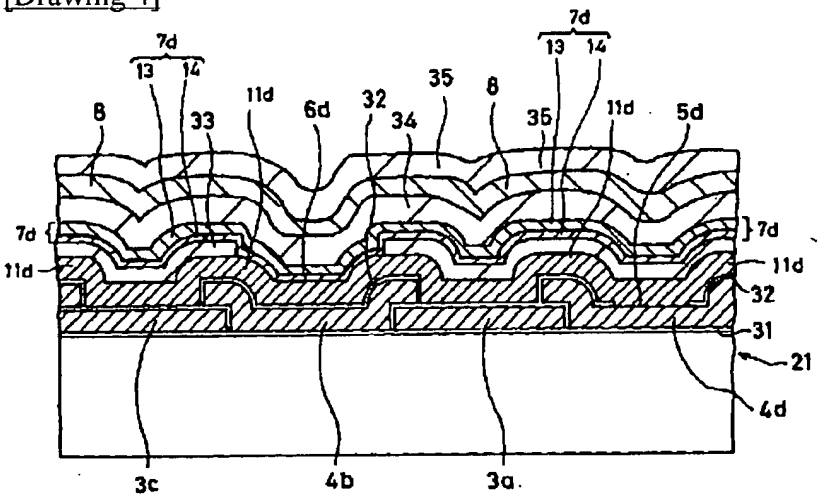
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

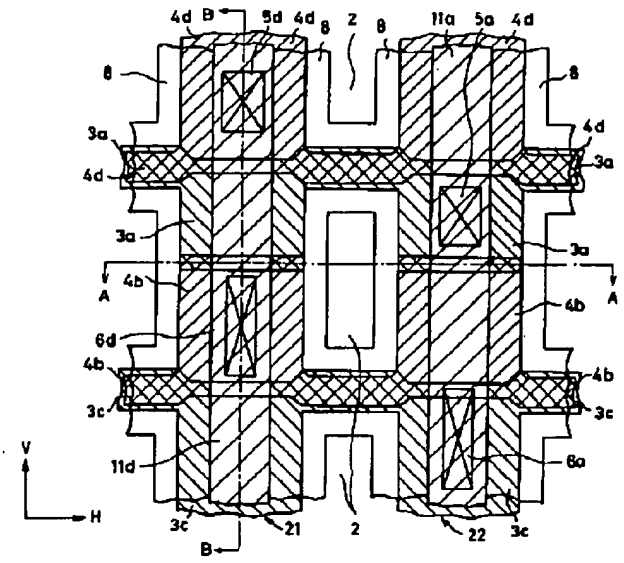
[Drawing 1]



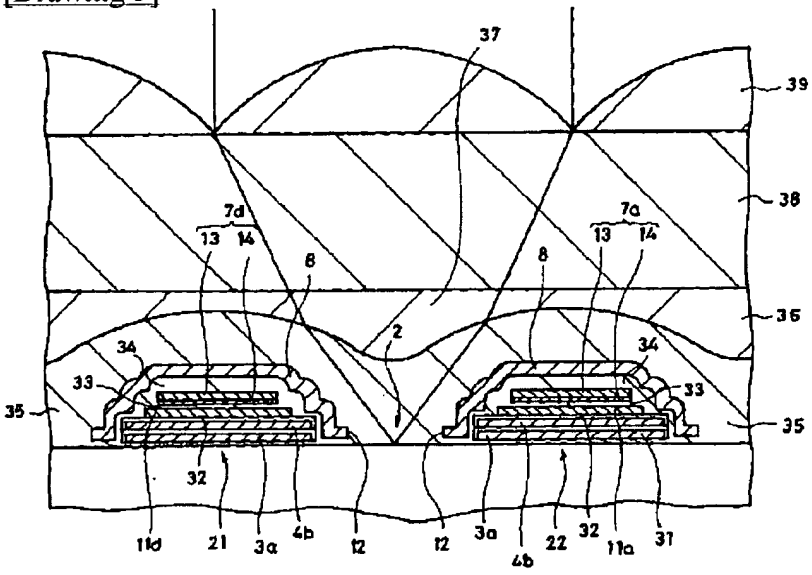
[Drawing 4]



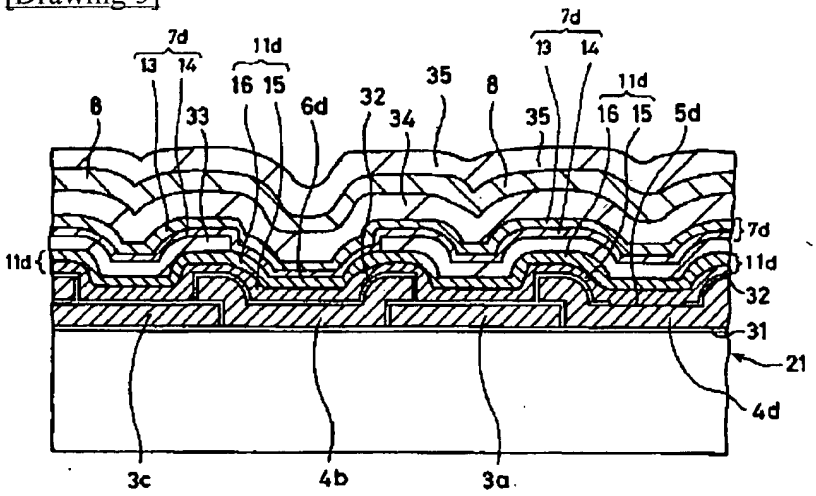
[Drawing 2]



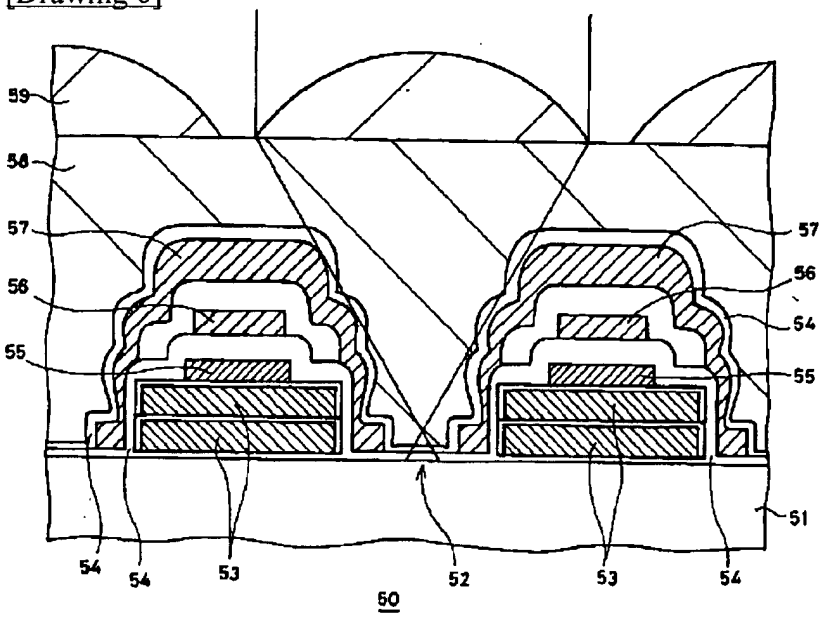
[Drawing 3]



[Drawing 5]



[Drawing 6]



[Translation done.]